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ABSTRACT

Measures of automaticity have shown different developmental trends in the speed and accuracy of processing in learning disabled (LD) and normally achieving children. This study extends this research to young adults, comparing the learning disabled with normal achievers. Its primary focus was to document the presence of basic processing deficits in adults similar to those characteristic of learning disabled children. Tasks sensitive to automaticity in work retrieval included rapid serial naming, Rapid Automatized Naming (RAN), and Rapid Alternating Stimuli (RAS), used to assess the speed of categorical and cross-categorical naming. Scores on these tasks were analyzed with respect to a measure of verbal retroactive inhibition--trigrams--purported to tap mechanisms of attention and processing. Results were further analyzed with respect to measures of reading achievement. Forty learning disabled and 40 normally achieving college students were matched by gender, age, and scores on the Peabody Picture Vocabulary Test-Revised. Results indicated that learning disabled adults were slower and more variable in automatized naming across all tasks. Additionally, the learning disabled were significantly poorer on trigrams performance than their normally achieving peers. When compared to achievement, the variance observed in automatized processes did not account for significant differences in reading levels; however, when the variance of trigrams was removed, significant differences in reading achievement were eliminated. The results of the investigation support the position that the learning disabled demonstrate deficits in basic processing skills involved in automatized processing. (Author/ABL)

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Automatized Processing in Learning Disabled Adults: RAN, RAS, and Reading

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Automatized Processing in Learning Disabled Adults: RAN, RAS, and Reading

Abstract

Measures of automaticity have shown different developmental trends in the speed and accuracy of processing in learning disabled (LD) and normally achieving children. This study extends this research to young adults, comparing the learning disabled with normal achievers. Its primary focus was to document the presence of basic processing deficits in adults similar to those characteristic of learning disabled children. Tasks sensitive to automaticity in word retrieval, included rapid serial naming, Rapid Automatized Naming (RAN) and Rapid Alternating Stimuli (RAS), used to assess the speed of categorical and cross-categorical naming. Scores on these tasks were analyzed with respect to a measure of verbal retroactive inhibition, trigrams, purported to tap mechanisms of attention and processing. Results were further analyzed with respect to measures of reading achievement. Forty learning disabled and 40 normally achieving college students were matched with gender, PPVT-R scores, and age. Each group was composed of 11 females and 29 males scoring within Average to Superior ranges of intellectual functioning.

Results indicated that learning disabled adults were slower and more variable in automatized naming across all tasks. Additionally, the learning disabled were significantly poorer on trigrams performance than their normally achieving peers. When compared to achievement, the variance observed in automatized processes did not account for significant differences in reading levels, however, when the variance of trigrams performance was removed, significant differences in reading achievement were eliminated.

The results of this investigation support the position that the learning disabled demonstrate deficits in basic processing skills involved in automatized processing. These findings also provide evidence that deficits characteristic of learning disabled children do not ameliorate with neurologic maturity and academic training found in adult, LD college students and lend support to the persistent nature of learning disabilities.

Automatized Processing in Learning Disabled Adults: RAN, RAS, and Reading

Learning disabilities have historically been considered a disorder of development stemming from a maturational delay in fundamental neurological processes (Lenneburg, 1967; Orton, 1937). Recent investigations have found evidence of permanent physiological deficits and cognitive dysfunction (Duffy, Denckla, Bartels, & Sandini, 1980; Galaburda & Kemper, 1979; Galaburda, Sherman, Rosen, Aboitiz, & Geschwind, 1985). Behavioral evidence of dysfunctional processing has also been found in adults (Bowen & Hynd, in press; Hayes, Hynd, & Wisenbaker, 1984). This study attempted to determine the extent to which inefficiency of cognitive processing, characterizing learning disabled children, is present in the adult population.

Neuropsychological procedures have been useful in assessing the Learning Disabled by systematic behavioral assessment for inference of neurological integrity. They have been shown to: 1) discriminate between the learning disabled and their normally-achieving peers (Geary & Gilger, 1984; Hynd & Snow, 1985); 2) differentiate the mildly from the severely learning disabled (Snow, Hynd, & Hartlage, 1985); and 3) distinguish between the learning disabled and other poor achievers (Oehler-Stinnett, Stinnett, Wesley, & Anderson, 1988).

Evidence suggests that physiological and behavioral disruptions of cognitive processes, observed in childhood, persist into the adult years (Bowen and Hynd, in press; Hayes et

al., 1984; Hecaen, 1983; Hynd, Obrzut, Weed, and Hynd, 1979). The theory would suggest that learning disabilities are of a constitutional origin, manifesting as inefficient cognitive processing, and consistent with neuropsychological definitions. While the disability may be identified in childhood, the underlying deficit persists through the life span.

Many underlying processes are necessary for the execution of complex cognitive processes, some require the smooth execution of component processes in fluid, automatized synchrony. Should a single component be dysfunctional, it would be reflected in the complex behavior by slowing its speed and efficiency. Automatized differ from "conscious" processes in that the latter require conscious components for their execution and automatic processes do not and is further differentiated by an absence of internal verbalization. The relationship is postulated as hierarchical: automaticity is involved in lower levels of linguistic processing, with conscious thought involved in more complex levels of propositional speech.

This functional relationship is believed to extend to all areas of processing (Benton, 1985). Visual-linguistic association normally becomes efficient, discontinuing the need to decode every element. The average achiever demonstrates the development of automatic decoding skills with advancing age, practice, and levels of sophistication in reading (Chall, 1983; Lesgold & Perfetti, 1981; Vellutino, 1982). Kuhn (1987)

identified phonemic decoding as a necessarily repeated process for the disabled reader. The ability to attend has been investigated with respect to reading skill, suggesting that with greater attention to the task of decoding, the more complex, effortful skills of comprehension might well suffer (Ackerman, & Dykman, 1982; Ackerman, Anhalt, Dykman, & Holcomb, 1986). Felton et al. have shown automatized naming skills to discriminate disabled readers, but not the attention deficit disordered student. While the coexistence of the difficulties are recognized, performance on fluid, automatized naming presented differently in each (Felton, & Wood, in press; Felton, Wood, Brown, Campbell, & Harter, 1987).

A series of investigations have suggested that learning disabled students respond more slowly in rapid serial naming, an assessment of response time for highly automatized skills. Particularly those who have reading difficulties demonstrate significantly slower response times, with greater variability in performance (Denckla, 1972; Denckla, & Rudel, 1974). A developmental progression of improved response times for both disabled and average readers is shown, however, significant differences continue through the developmental period (Wolf, 1984; Wolf, 1986; Wolf, Bally, & Morris, 1986). The persistence of significant differences into the adult years, when neurological maturity has been achieved, would support the neuropsychological definition of learning disabilities and provide evidence of processing deficits in adults.

Methodology

Subjects were undergraduate students between the ages of 18 and 27 years, inclusive. They were divided into two groups: the Learning Disabled, comprised of students diagnosed at the college level and the Normal, consisting of students who demonstrated average levels of academic achievement. Members from each group were matched by chronological age (mean age = 21-10), gender, and IQ (± standard error of measure). Of the 80 participants in both groups, 22 were female and 58 were male. Scores from a measure of intellectual functioning fell within the Average to Superior ranges for all subjects (PPVT-R, mean = 105.55).

All students received the Peabody Picture Vocabulary Test-Revised, a measure of general intellectual ability and the Woodcock-Johnson Psycho-Educational Battery-Part Two-Tests of Achievement, Reading Cluster. Rapid serial naming tasks were used as measures of automaticity in word retrieval. Rapid Automatized Naming (RAN) Tasks and Rapid Alternating Stimulus (RAS) Tasks were constructed according to the format of Denckla and Rudel (1976a, 1976b). Each participant was tested individually using a Singer Caramate individual slide viewer. Trigrams were used as an estimate of additional, effortful processing, as empirical, neuropsychological investigations have paired the task with processes of attention, inhibition, and perseveration. (McGoech, 1942; Passler et al., 1986).

Results

No statistical difference was found on mean intelligence scores ($t = -0.08$, $p < .9332$) or on age ($t = -0.42$, $P < .6769$).

As expected, analyses revealed significant differences on measures of reading skill: Letter-Word Identification, Word Attack, and total Reading Cluster. No differences were found in Passage Comprehension.

Mean scores were also compared using subjects' performance on the trigrams task (LD: X(sd) = 22.65 (3.72); Normal: X(sd) = 26.33 (3.35). A dependent groups T-test on mean differences indicated a high level of statistical significance with regard to the relatively poorer performance of the learning disabled on the series of 10 trigrams ($t = -4.29$, $p < .0001$).

All rapid serial naming tasks revealed significant differences between groups. Dependent groups t-tests were highly significant in discriminating the Learning Disabled and Normal groups for RAN tasks ($p < .0001$). The Learning Disabled required consistently longer response times to complete each series of rapid, single categorical naming as compared to the matched normals. Dependent groups t-tests on each of the four RAS sets yielded highly significant differences between groups ($p < .0001$). Learning Disabled subjects required a significantly longer time for the serial naming of all sets of cross-categorical stimuli than did their matched Normals.

Mean differences in RAN and RAS response times for the two groups were analyzed by covariate adjusted T-tests, with the trigrams task as covariate. Differences persisted at a minimum of $p < .001$ on all data sets. However, in multiple regression analyses, with RAN and RAS as predictor variables, none were

significant in the prediction of reading skills; adjusted variance estimates were less than 10%.

Mean differences in reading for the two groups were also analyzed by covariate adjusted T-tests, with the trigrams task as covariate. The degree of difference between groups, shown to be significant across three of the four reading subtests in the initial T-test, were no longer significant when the difference attributable to performance on trigrams was removed.

Implications

Results support previous evidence that differences between the Learning Disabled and normal achiever do, indeed, continue to persist into the adult years. The degree of significance of those differences in both automatic processing and effortful tasks was striking. Even more remarkable, however, was the failure of rapid serial naming tasks to emerge as viable predictors of differences which appear in reading, characterizing the learning disabled group. Conscious, attentional skills, like those assessed by Trigrams, were most relevant in the assessment of skills differences in reading.

Further research is needed to determine the degree to which automatized processes appear deficient in alternative manifestations of learning disabilities, e.g., dysgraphia. Subtyping information, as well as cross-modal assessment paradigms, are areas needing further investigation to better delineate relative contributions of global processing skills.

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